

What is claimed is:

1. In a system recording and playing back a transport stream transmitted by a digital broadcast, a digital video
5 record/playback apparatus comprising:

an output control unit outputting a predetermined playback mode;

a transmission control unit controlling a transmission bit rate and transmission time point of the transport stream based on
10 the predetermined playback mode and VBV (video buffering verifier) buffer status information;

a demux performing an STC (system time clock) count initialization and STC count control on a PCR (program clock reference) packet of the transport stream inputted via the
15 transmission control unit, the demux extracting ES (elementary stream) data for a program data packet of the transport stream;

a VBV buffer temporarily storing the extracted ES data, the VBV buffer playing a role in buffering between the transmission bit rate and a decoding frame rate, the VBV buffer outputting a
20 buffer status to the transmission control unit; and

a decoder adjusting DTS (decoding timestamp) according to the predetermined playback mode of the output control unit, the decoder controlling a decoding time point by comparing the

adjusted DTS to an STC count value and decoding the ES data outputted from the VBV buffer.

2. The apparatus of claim 1, wherein the transmission

$$R_n = \frac{B - B_n}{t_{n+1} - t_n}, \text{ if } R_n \leq R_{t\max}$$

5 control unit adopts an equation of {

$$R_{t\max}, \text{ if } R_n > R_{t\max}$$

to control the transmission bit rate R_n in case of a normal playback mode and wherein $t_{n+1} - t_n$ is a decoding cycle, $B - B_n$ is a vacant quantity of the VBV buffer, and $R_{t\max}$ is a maximum transmission bit rate.

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3. The apparatus of claim 1, wherein the transmission control unit controls the decoding time point by adjusting the DTS by adopting an equation of

$$\begin{cases} DTS'_n = DTS_0, & n=0 \\ DTS_0 + \frac{DTS_n - DTS_0}{N}, & n \neq 0 \end{cases} \text{ in case of an N-times speed}$$

15 forward trick play mode and wherein DTS'_n is a new DTS value corresponding to the decoding time point and DTS_0 is a DTS value of a first picture at the beginning of a trick play.

4. The apparatus of claim 1, wherein the transmission
20 control unit controls the decoding time point by adjusting the DTS by adopting an equation of

$$\begin{cases} DTS'_n = DTS_L, & n=0 \\ DTS_L + \frac{DTS_L - DTS_n}{N}, & n \neq 0 \end{cases} \text{ in case of an N-times speed}$$

reverse trick play mode and wherein DTS'_n is a new DTS value corresponding to the decoding time point and DTS_L is a DTS value of a first I picture at the beginning of a reverse trick play.

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5. The apparatus of claim 1, wherein the transmission control unit outputs a PCR value of a next picture following a picture to be played back as a PCR value to be transmitted for the STC count initialization in case of an N-times speed reverse

10 trick play mode.

6. The apparatus of claim 1, wherein if a playback mode and a first picture to be played back are determined, the demux initializes an STC count value becoming a reference of the

15 decoding time point with a PCR value of the determined picture and an STC count is then synchronized with an STC (system count clock) according to a playback direction to be sequentially incremented or decremented.

20 7. The apparatus of claim 1, wherein the decoder determines the decoding time point by comparing the sequentially

incremented or decremented STC count value to a readjusted DTS value.

8. A digital video record/playback apparatus comprising:

5 a record control unit only selecting transport packets corresponding to a program to be stored in a transport stream, the record control unit extracting picture information and PCR (program clock reference) of the program to be used in playback;

10 a storage medium storing the transport packets of the program selected in the record control unit, the picture information, and the PCR of the selected program;

an output control unit outputting a predetermined playback mode;

15 a transmission control unit controlling a transmission bit rate and transmission time point of the transport stream based on the predetermined playback mode and VBV (video buffering verifier) buffer status information;

20 a demux performing an STC (system time clock) count initialization and STC count control on a PCR (program clock reference) packet of the transport stream inputted via the transmission control unit, the demux extracting ES (elementary stream) data for a program data packet of the transport stream;

a VBV buffer temporarily storing the extracted ES data, the VBV buffer playing a role in buffering between the transmission

bit rate and a decoding frame rate, the VBV buffer outputting a buffer status to the transmission control unit; and

a decoder adjusting DTS (decoding timestamp) according to the predetermined playback mode of the output control unit, the
5 decoder controlling a decoding time point by comparing the adjusted DTS to an STC count value and decoding the ES data outputted from the VBV buffer.

9. The apparatus of claim 8, wherein the record control
10 unit stores information of a location where a picture is stored, information of a location where a PCR value of the picture is stored, and each picture type in the storage medium, wherein the record control unit stores associative relation to the location information of the picture recorded in the storage medium by
15 searching index information of the picture type, and wherein a time stamp is not stored in the storage medium.

10. The apparatus of claim 8, wherein the storage medium
has a large capacity of storing digital video streams and is
20 randomly accessible.

11. The apparatus of claim 8, wherein the transmission

$$R_n = \frac{B - B_n}{t_{n+1} - t_n}, \text{ if } R_n \leq R_{t\max}$$

control unit adopts an equation of {

$$R_{t\max}, \text{ if } R_n > R_{t\max}$$

to control the transmission bit rate R_n in case of a normal playback mode and wherein $t_{n+1} - t_n$ is a decoding cycle, $B - B_n$ is a
5 vacant quantity of the VBV buffer, and $R_{t\max}$ is a maximum transmission bit rate.

12. The apparatus of claim 8, wherein the transmission control unit controls the decoding time point by adjusting the

10 DTS by adopting an equation of

$$\begin{cases} DTS'_n = DTS_0, & n=0 \\ DTS_0 + \frac{DTS_n - DTS_0}{N}, & n \neq 0 \end{cases} \text{ in case of an N-times speed}$$

forward trick play mode and wherein DTS'_n is a new DTS value corresponding to the decoding time point and DTS_0 is a DTS value of a first picture at the beginning of a trick play.

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13. The apparatus of claim 8, wherein the transmission control unit controls the decoding time point by adjusting the

DTS by adopting an equation of

$$\begin{cases} DTS'_n = DTS_L, & n=0 \\ DTS_L + \frac{DTS_L - DTS_n}{N}, & n \neq 0 \end{cases} \text{ in case of an N-times speed}$$

reverse trick play mode and wherein DTS_n' is a new DTS value corresponding to the decoding time point and DTS_L is a DTS value of a first I picture at the beginning of a reverse trick play.

5 14. The apparatus of claim 8, wherein the transmission control unit outputs a PCR value of a next picture following a picture to be played back as a PCR value to be transmitted for the STC count initialization in case of an N-times speed reverse trick play mode.

10 15. The apparatus of claim 8, wherein if a playback mode and a first picture to be played back are determined, the demux initializes an STC count value becoming a reference of the decoding time point with a PCR value of the determined picture
15 and an STC count is then synchronized with an STC (system count clock) according to a playback direction to be sequentially incremented or decremented.

20 16. The apparatus of claim 8, wherein the decoder determines the decoding time point by comparing the sequentially incremented or decremented STC count value to a readjusted DTS value.

17. A playback method in a digital video record/playback apparatus, comprising:

a step (a) of storing transport packets of a selected program, picture information, and PCR (program clock reference) of the selected program;

a step (b) of performing STC (system time clock) count initialization using a value of the stored PCR and incrementing or decrementing an STC count according to a direction of a trick play mode;

a step (c) of adjusting DTS (decoding timestamp) of a picture to be decoded according to the direction and multiple-times speed of the trick play mode; and

a step (d) of decoding to output picture data of the selected program by controlling a decoding time point by comparing a value of the adjusted DTS to a value of the incremented or decremented STC count and by referring to the picture information according to the trick play mode.

18. The playback method of claim 17, wherein in the step (b), the STC count is sequentially incremented in case of a forward trick play or sequentially decremented in case of a reverse trick play.

19. The playback method of claim 17, wherein in the step (c), the decoding time point is controlled by adjusting the DTS

$$\begin{aligned} DTS'_n &= DTS_0, & n=0 \\ \text{by adopting an equation of } \{ & \\ DTS_0 + \frac{DTS_n - DTS_0}{N}, & n \neq 0 \end{aligned}$$

in case of an N-times speed forward trick play mode and wherein
5 DTS_n' is a new DTS value corresponding to the decoding time point
and DTS₀ is a DTS value of a first picture at the beginning of a
trick play.

20. The playback method of claim 17, wherein the decoding
10 time point is controlled by adjusting the DTS by adopting an

$$\begin{aligned} DTS'_n &= DTS_L, & n=0 \\ \text{equation of } \{ & \\ DTS_L + \frac{DTS_L - DTS_n}{N}, & n \neq 0 \end{aligned} \quad \text{in case of an N-}$$

times speed reverse trick play mode and wherein DTS_n' is a new
DTS value corresponding to the decoding time point and DTS_L is a
DTS value of a first I picture at the beginning of a reverse
15 trick play.